Jacobi, Gauss Seidel y Gauss Seidel (SOR)

1) We ask the user for a matrix. We call the matrix A. The matrix must be a square matrix.

2) We ask for a vector b and we make sure that it is the same length as matrix A.

3) Now ask the user for an initial value approximation which we will call x0, a tolerance (tol) and we make sure it is not negative, we also aks for a maximum number of iterations(Nmax), which also has to be nonnegative, l (it will be 1 if you want to execute Jacobi, or 2 if you want to execute Guass Seidel) y w if you want to use the method of relation.

4) We make sure that A does not have any 0's in the diagonal, and that the det(A) $\neq 0$.

5) Now make 3 new matrices, named D, L and U. All must be the same size as A and must have the following parameters:

   a) D must be a matrix that has the same main diagonal elements that matrix A has and the rest of the elements must be 0.

   b) L will have the same elements that are below the diagonal in A but with the opposite sign. The diagonal in L will be the same as A, and all other elements will be 0.

   c) U will have the same elements in A that are above the diagonal with opposite signs, and will have the same elements in the diagonal as A and the rest of the elements will be 0.

6) Now we begin to execute the method.

   a) If l is equal to 1, execute Jacobi method,

      (i) $T = D^{-1} * (L+U)$

      (ii) $C = D^{-1} * b$

   b) If l is equal to 2 execute the Gauss Seidel Method:

      (i) $T = (D-L)^{-1} * U$

      (ii) $C = (D-L)^{-1} * b$

   c) All other cases execute SOR

      (i) $T = (D-w* L)^{-1} * ((1-w)* (D+w* U))$

      (ii) $C = (w* (D-w* L))^{-1} * b$

7) Now we find and make the spectral radiance as the as the absolute value of the largest proper values making sure they are less than 1.

8) Now we make a counter for the iterations beginning with 0, a variable for the error which begins with 1, and a variable for the old X , we will call Xant, and we will start it off as Xant=x0 our initial approximation

9) Now we make a cycle, while the Error $>$ the tolerance , iterations(counter) $<$ Nmax, Do:

   a) Xact = Xant$*$ T+C

   b) Error = norm of Xant – Xact

   c) Xant = Xact

   d) Counter++